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<p>(54) Title: METHOD, SYSTEM, APPARATUS AND PROGRAM PRODUCT FOR DISTRIBUTION AND INSTANTIATION OF SOFTWARE UPGRADES</p> <p>(57) Abstract</p> <p>Software version upgrades are distributed and instantiated in a distributed computing environment. This includes defining the required versions of software as the contents of a software version upgrade kit. The software upgrade kit is written, e.g. as a table of contents or a list, to a database to generate software upgrade kit tables. The tables are used to generate software version upgrade kits. The kits are then used as a source to download copies of the upgrade kits to clients to be upgraded. This enables upgrading the software on the client.</p>			

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**METHOD, SYSTEM, APPARATUS AND
PROGRAM PRODUCT FOR DISTRIBUTION AND
INSTANTIATION OF SOFTWARE UPGRADES**

FIELD OF THE INVENTION

- 5 This invention relates to a system, method, and program product for providing software updates online. The updates may be provided to one or more of a sequence of individual computers, or to a network of computers. In a preferred exemplification, the software updates are provided to individual clients in a client server-network, for example a client-server network of the type executing a partially replicated relational 10 database or transaction processing system, an enterprise on a WAN or a LAN.

BACKGROUND OF THE INVENTION

Business enterprises utilize large numbers of terminals, i.e., desktop computers, portable computers, and network terminals to carry out their activities. While it is desirable that all of these terminals have identical images, interfaces, and software, 15 this is not always possible when a continuum of terminal ages and capabilities exists in an enterprise. However, it is absolutely essential that the set of terminals in an enterprise be able to communicate effectively. This requires careful planning for and coordination of software migration efforts.

In a system including one or more central databases (including correspondence 20 databases and such databases as are contemplated in groupware applications such as Lotus Notes, Novell GroupWise, and the like) and locally partially replicated databases, there is considerable amount of software which is often customized to meet the needs of particular enterprise, and even particular users and groups of users within elements of the enterprise. A great deal of effort is expended on configuring the 25 software and writing custom modules and objects. If the software is upgraded to a new release, a considerable amount of programming time and effort are required to provide consistent upgrades while configuring the new release and reimplementing the customer-specific functionality of the earlier versions.

It is therefore desirable to provide a capability to provide a facility which allows 30 enterprises to rapidly migrate their changes from one version of the software to another version of the software, such as configurations and objects.

It would be desirable to accomplish rapid migration of software upgrades in a user-friendly, on-line method through the use of on-line distribution of software upgrades.

OBJECTS OF THE INVENTION

It is an object of the invention to provide on-line distribution of software upgrades
5 while satisfying the following business requirements:

It is a primary object of our invention to provide database schema synchronization.

It is a further object of our invention to provide support for all types of installations
and terminals in an enterprise. That is, the sol. are provider or the upgrader, e.g., the
database administrators must be able to upgrade all types of the installations in an
10 enterprise, including connected clients, remote clients, regional servers and
application servers.

It is a still further object of our invention to provide support for the upgrading of third
party software.

It is still a further object of our invention to support both full and partial upgrades
15 installed software in an enterprise.

An additional object is restartability. This means that the upgrade software must track
the progress of upgrades and automatically roll back changes when an error occurs,
and the upgrade software must also be able to restart the upgrade from the last save
point.

20 An important object of the invention, especially in an enterprise characterized by
heterogeneity and/or geographical dispersion is centralized definition and monitoring.
upgrader, e.g., the database administrators must be able to easily define and distribute
software and schema upgrades from a central location and to monitor the progress of
upgrades across all installations.

25 The upgrade must be able to stand alone. This means that upgrades must be able to
run by themselves, and not depend on other programs or data.

Finally, these objects must be attained and maintained while preserving ease of use
and user friendliness.

SUMMARY OF THE INVENTION

These and other objects are obtained by the method, apparatus, system, and program product of our invention.

- Our invention provides software version upgrades and database schema synchronization. The software provider or upgrader, e.g., the database administrator, applies and distributes database schema changes to all remote databases including mobile databases and regional databases. Moreover, the software provider or upgrader, e.g., the database administrator, applies minor schema changes (e.g. database extensions), patches and major schema changes without manual intervention.
- According to our invention, it is possible to provide sol, are version upgrade all types of installations. That is, the software provider or the upgrader, e.g., the database administrators is now able to upgrade all types of installations and terminals, including connected clients, remote clients, regional servers, and application servers.

One aspect of our invention is a method of distributing and instantiating software version upgrades in a distributed computing environment. This method includes setting the minimum (and maximum) levels of the version for installed software, and using those levels to define the contents of software version upgrade kits. The contents of the software version upgrade kits are then written to a database, e.g., as a table of contents or the like, and used top generate software version upgrade kit tables. These tables are used to build software version upgrade kits. Copies of the upgrade kits are downloaded to clients to be upgraded; and the software on the client is upgraded.

After the table of contents of the software upgrade kits is installed, it is compared to the locally installed software on a client, with the Software needing to be installed on the client to the client being downloaded to the client. This comparison can be at the startup of the server, the client, or a particular software component.

When the client is a mobile client the comparison and download are carried out at a docking session, with instantiation of the upgrade either during the current docking session or during a subsequent docking session

In one exemplification of our invention the distributed computing environment is database management system having replicated or partially replicated databases, and the database schema version on the client is compared to the database schema version on server, with reinitialization of the database version on the client if the database 5 schema version on the client and the server do not match, and synchronization of the database the client with the database on the server if the database schema versions on the client and server match.

According to our invention there is support for third party software. The software provider or upgrader, e.g., the database administrators is able to upgrade third party 10 software that customer installations depend on. For example, the software provider, management information services supervisor, or upgrader, e.g., the database administrator, is able to upgrade Microsoft Word, Adobe Acrobat, Microsoft Access and the like residing on customer installations.

Full and partial upgrades are enabled according to the method and apparatus of our 15 invention. Upgrader, e.g., the database administrator, s may upgrade all or part of an installation. For example, the upgrader, e.g., the database administrator, is able to distribute both a completely new installation and a patch for an existing installation such as a CDF file, an executable, a DLL, a report, and the like. In a like manner, upgrader, e.g., the database administrators is able to distribute upgrades for different 20 languages.

These objects are attained while maintaining ease of use and user friendliness. In this regard, ease of use requires automatic detection of existing program and automatic invocation of upgrade programs, including clients and replication agents. The installation software must automatically detect when an upgrade is available and can 25 be applied to the local installation, such that the user does not need to explicitly find and choose upgrades. User-friendliness requires that software upgrade programs must let the user cancel or defer upgrades. The software upgrade programs must keep the user informed on the status of upgrades, inform the user of pending upgrades, the user steps to be performed in an upgrade, time estimates for the upgrade, and progress 30 indicators during the upgrades. This includes self upgrading, upgrades must be able to upgrade themselves., and upgrader, e.g., the database administrator, s must be able to distribute upgrades for the upgrade programs. User-friendliness also includes a

requirement adaptivity. That is, the ability for individual users to use any method to install or update software components, whether using an upgrade wizard or not. upgrades should use current state of the software components to identify whether an upgrade is needed.

5 A related requirement is restartability. That means that the upgrade software must track the progress of upgrades and automatically roll back changes when an error occurs, and the upgrade software must also be able to restart the upgrade from the last save point.

A desirable property is the availability of early downloads. By this expedient, mobile
10 users can download and apply upgrade kits to their local machines even before the upgrade is required. This lets mobile users download the upgrade when they have more time or have access to a fast network (e.g. visiting HQ).

A further desirable property is centralized definition and monitoring, upgrader, e.g., the database administrators must be able to easily define and distribute software and
15 schema upgrades from a central location. Moreover, upgrader, e.g., the database administrator, s must be able to monitor the progress of upgrades across all installations. For example, the upgrader, e.g., the database administrator, must be able to find all installations that have applied an upgrade. This includes guaranteed delivery. All upgrades are distributed and applied to all installations The upgrader,
20 e.g., the database administrator, must not have to explicitly monitor the status of upgrades on every installation.

Our invention provides be support for Test and Production environments, upgrader, e.g., the database administrator, s must be able to configure and test upgrades in a test environment, and thereafter, easily migrate the changes to a production environment
25 for distribution to all production users.

The upgrades applied by our invention are able to stand alone. This means that upgrade are able to run by themselves, and do not depend on other programs or data.

Installation of upgrades according to our invention requires minimal network traffic. It is important to minimize file transfers by sending upgrades to only the sites that

need them. For example, application server upgrades are only sent to regional data installations. Microsoft Word upgrades are only sent to client installations.

THE FIGURES

Our invention may be understood by reference to the FIGURES and TABLES
5 appended hereto.

FIGURE 1 illustrates the process of defining software upgrades. As shown in the FIGURE, the administrator defines the upgrade kits, thereby generating upgrade kit files. Next, the client writes the upgrade kit definition to the server database resident in the database server, generating further upgrade kit files. The client also copies
10 upgrade kit files to the file server. When the upgrade kit files are to be released, upgrade kit archive files are created.

FIGURE 2 illustrates initiation and distribution of upgrades. In the process shown in FIGURE 2 the administrator updates the required versions for a software item. This causes the database server, when started up, this causes the client to compare the
15 required versions of the software with the locally installed versions for each software item. If an upgrade is required the client retrieves the upgrade kit archive file from the file server and invokes the upgrade wizard to apply the upgrade locally. Also shown in FIGURE 2 is upgrading of mobile users. In the case of mobile users an application server routes new required versions to mobile and regional users. After a
20 docking session, the docking client compares the required versions to locally installed versions of the software. If an upgrade is required, the docking client retrieves the upgrade kit archive file from the file server and invokes the upgrade wizard to apply the upgrade the local machine.

FIGURE 3 illustrates the upgrade procedures for customers. As shown in FIGURE
25 upgrade distribution CD's or diskettes are created and shipped to customers. The customer upgrades a test environment, distributes new version of the software testing, and tests the software. If the test is satisfactory, the customer upgrades the new version to production users.

FIGURE 4 is a data model for a remote upgrade. It shows the upgrade kit, a kit component, including a component, and a related component, a kit item and kit item argument, and a kit item type argument.

TABLE I shows an enumeration of the valid actions for the upgrade kit items, such as
5 copying files into directories, deleting files from directories, invoking stand-alone executables, running statements in SQL files, loading data, issuing ddl, and loading repository files.

DETAILED DESCRIPTION OF THE INVENTION

Implementation Overview

10 The definition of upgrades, the initiation and distribution of upgrades, and end-user level upgrading are illustrated in the FIGURES.

As shown in FIGURE 1, the administrator, shown as the client (101) defines the upgrade kits. The client (101) writes this upgrade kit definition to a server database (103) resident in the database server, generating upgrade kit tables (104) in the server
15 database (103). The step of defining the upgrade at the client (101) also generates upgrade kit files (102). The client copies these upgrade kit files (102) to the file server (105), for example, for subsequent downloading. When the upgrade kit files (106) are to be released, upgrade kit archive files are created.

FIGURE 2 illustrates initiation and distribution of upgrades. In the process shown
20 FIGURE 2 the administrator (101) updates the required versions for a software item.

This causes the database server (103), with resident software component tables (104A), when started up, to compare the required versions of the software with the locally installed versions for each connected local user (211) for each software item. If an upgrade is required the local user (211) retrieves the upgrade kit
25 archive file (106) from the file server (105) and invokes an upgrade wizard to apply the upgrade locally.

Also shown in FIGURE 2 is upgrading of mobile users (215). In the case of mobile users (215) an application server (213) routes new required versions to mobile (215) and regional users. After a docking session, the docking client compares the required

versions to locally installed versions of the software. If an upgrade is required, the docking client retrieves the upgrade kit archive file (106) from the file server (105) and invokes the upgrade wizard to apply the upgrade to the local machine (215).

FIGURE 3 illustrates one set of test and distribution procedures for customers. As shown in FIGURE 3, upgrade CD's or diskettes (307) are created in a master repository (305) and shipped to a test database server (303) for distribution to test users, including server test users (313), connected test users (311), and mobile test users (315). The test users (311, 313, and 315) upgrade their test environments, and the upgraded version of the software for testing. The customers (311, 313, 315) test the software. If the test is satisfactory, the newly upgraded version of the software is distributed to production users (4121, 413, 415).

FIGURE 4 illustrates a data model for a remote upgrade. It shows the upgrade kit (1001), a kit component (1003), including a component (1005), and a related component (1007), a kit item (1009) and kit item argument (1011), and a kit item type (1013).

Software Components

The basic unit of upgrades is the software component. A software component is a set of software that can be separately installed and tracked by upgrades. Each software component has a range of required versions. The software vendor, the MIS supervisor, or the upgrader, e.g., the database administrator, specifies the range of required for each software component. Examples of software components in, by way of exemplification only and not limitation, the Siebel Remote application are the Siebel Schema, the Siebel Client, the Siebel Server and Microsoft Word.

Upgrade Kits

The software vendor, MIS supervisor, or upgrader, e.g., the database administrator, creates upgrade kits to install or upgrade one or more software components. An upgrade kit is a collection of files and actions to upgrade one or more software components from one version to another (usually higher) version. To initiate an upgrade of a software component, the upgrader, for example, the upgrader, e.g., the database administrator, builds and releases an upgrade kit to install the new version of

the software component. Then the upgrader, e.g., the database administrator, updates the software component's required versions to ensure that users upgrade to the new required version of the software component.

Automatic Upgrade Detection

- 5 At certain pre-defined times (e.g. client startup, before and after each synchronization session, before invoking a third party software component, when the Server starts up), system programs verify that software components for the currently running program are up-to-date. For example, in the case of Siebel Remote, the Siebel Client checks the versions of the Siebel Schema and Siebel Client components, but does not necessarily check the Siebel Server component. The server determines the currently installed version of a software component by interrogating the software component itself and comparing the installed versions against the required versions.
- 10

If any software component is not within the range of required versions, the server checks the versions of all software components and searches for one or more upgrade 15 kits upgrade the out-of-date software components to the required versions. The server then informs the user of the required upgrades and prompts the user to perform the upgrade.

Upgrade wizard

The server invokes an upgrade wizard to apply an upgrade kit. After invoking the 20 upgrade wizard, the program exits so as to release any locks on database tables or files that need to be upgraded. For example, the client invokes the upgrade wizard and exits. The Server sends a shutdown messages to all currently active server components, waits for all server components to stop, invokes the upgrade wizard and exits.

- 25 The upgrade wizard is preferably a standalone single executable (no DLLs required) that can read and apply an upgrade kit to the local machine. The upgrade wizard keeps track of the upgrade's progress and automatically recovers from errors. For example, it creates a back up of the local database and local files while applying an upgrade kit. If an error occurs anytime during the upgrade, the upgrade wizard

10

attempts to rollback all the changes and restores the local machine to the original state.

When the Client or Server starts, it detects whether an upgrade is in progress or has failed. If so, it informs the user and invokes the upgrade wizard to restart the upgrade.

- 5 For the Client, if the user declines to restart the upgrade, the Client continues in read-only mode. In read-only mode, the client lets the user view data but prevents the user from modifying data. For the Server, if the upgrader, e.g., the database administrator, declines to restart the upgrade, the Server issues an error message and stops.

- After successfully completing an upgrade, the software components on the local
10 machine should be up-to-date. The upgrade wizard restarts the original program that
invoked the upgrade.

Using Upgrades

This section describes the process for defining, distributing and applying an upgrade more detail.

15 Customize

The upgrader, e.g., the database administrator, uses tool programs and other programs to customize the database management system for their environment. The upgrader, e.g., the database administrator, has the capability to extend the database schema and customize client screens, report files and other files.

20 Define Upgrades

The Upgrader, e.g., the database administrator, defines the upgrade in the server database. This process consists of defining the software components and the upgrade kits needed to upgrade each software component to a specific version.

Define Software Components

- 25 The upgrader, e.g., the database administrator, uses a Software Component screen or tool to define new software components. A software component is a set of software that can be separately installed, tracked and de-installed by upgrades. As used herein, a software component has the following attributes:

Name. A name to identify the software component

Required Versions. A range of versions, that is, the minimum and maximum versions, that must be installed on each machine.

5 Locate Method. A specification of how to detect whether the software component is installed on a machine. For example, read the windows registry to identify where Microsoft Windows is installed on the local machine.

10 Version Method. A specification of how to identify the current version of installed software component on a machine. For example, read the Windows registry to get the currently installed version of Microsoft Word on the local machine.

15 "Compiled" component information. Information about the previously released version of the software component. For example Siebel Remote stores exactly two versions of software components. The user can view and manipulate the current version. Siebel Remote stores the previously released version in a LONG column in the software component table (i.e. S_UPG_COMP). The upgrader, e.g., the database administrator, uses the Component screen to copy the current version into the "compiled" LONG column.

20 Schema. The schema is the database schema, also referred to as a meta-database. This includes the database tables, indexes, views, seed data and repository data that must be installed in the database to run.

Client. The executables, dlls, reports, help files needed to run the client.

CDF. The definition of a customer's configuration for the client.

Server. The executables, dlls and other files needed to run the server.

25 Upgrade wizard. The standalone executable that applies upgrade kits on machine.

For most end users, the predefined set of software components described above complete. If needed, the upgrader, e.g., the database administrator, can also define one software components that they want to distribute and apply to their users.

Define Upgrade Kits using the Upgrade Kit screen

- 5 In a preferred embodiment of our invention, the upgrader, e.g., the data administrator, uses an Upgrade Kit screen to define an upgrade kit to install one or more software components.

Each upgrade kit must contain all the files and commands needed to install the software components. For example, an upgrade kit can be used to install Microsoft
10 Word 7.0.2 on all clients. This upgrade kit must contain all the files (e.g. executables, sample files, templates, etc.) and commands (e.g. update the registry, build short cuts, etc.) to install Microsoft Word 7.0.2. The upgrader, e.g., the database administrator, provides the following information when defining an upgrade kit:

Upgrade kit information. Provide a name, a title and a description of the upgrade kit.

15 Upgrade kit items. The upgrader, e.g., the database administrator, defines a set of actions (or "items") that the upgrade wizard runs in sequence to apply the upgrade kit. Error! Reference source not found, shows a list of possible upgrade kit items. The upgrader, e.g., the database administrator, pre-creates the files for the upgrade kit and registers them with the upgrade kit.

20 Required component versions. The upgrader, e.g., the database administrator, also defines the list of required software components that must be installed to apply the upgrade kit. For example, an upgrade kit to import data into the database might require that SQL Anywhere v5.5 be installed.

25 Component versions to install. The upgrader, e.g., the database administrator, also defines the list of software components that the upgrade kit applies. For example, an upgrade kit to execute a file might install Microsoft Word 7.0.2.

The Upgrade Kit screen provides a wizard to help creating upgrade kits at customer sites. The Upgrade Kit Wizard lets upgrader, e.g., the database

administrator, create upgrade kits for software components that users can customize.

After the upgrader, e.g., the database administrator, finishes defining an upgrade, he or she saves the result, for example, by issuing a command, for example, pressing the 5 “Release” button on the Siebel Upgrade Kit screen, to make the upgrade kit available to all installations. The command, for example, the button, does the following:

- Generates an upgrade wizard driver file for the upgrade kit.
- Creates an upgrade kit archive file and stores it in the file system. The archive file consists of the upgrade wizard driver file and all the files needed to apply 10 the upgrade kit to a machine.
- Compiles the upgrade kit information into a “compiled” LONG column. This “compiled” column stores all the information needed by programs to find the upgrade kits. This “compiled” column is provided to reduce the time to find upgrade kits.

15 Deploy Upgrades

After defining the upgrade, the upgrader, e.g., the database administrator, then initiates the upgrade from the server database. Client programs at all locations automatically detect and apply the upgrades as needed.

Early Download of Upgrade Kits

- 20 After the upgrade kit is defined, it is possible to distribute the upgrade kit definitions associated files to mobile and regional databases. In this case mobile users can navigate to the Upgrade Kit screen and request that the database management system download the upgrade kit archive file in the next synchronization session. This lets mobile users download large upgrade kit archive files long before the upgrade kit 25 needs to be applied to the local machine. For example, the mobile user may be visiting headquarters and can download the upgrade kit archive file in much less time over the LAN than over a modem.

Early download of upgrade kits is not mandatory for mobile users. The mobile user does not need to explicitly request the upgrade kit archive file: The database management software can automatically download the upgrade kit archive file if it needs to apply the upgrade kit and the upgrade kit archive file is not accessible on the local machine.

Initiate Upgrades

- After defining software components and upgrade kits, the upgrader, e.g., the database administrator, can initiate an upgrade of the software component. The upgrader, e.g., the database administrator, must first set the required versions of the software component. There are two ways of setting the required versions: The first way is through the component screen. The upgrader, e.g., the database administrator, uses the component screen to manually update the required versions for a software component. He or she uses the screen to modify the minimum or maximum required version of one or more software components.
- Alternatively, the upgrader, e.g., the database administrator, can utilize an Upgrade Kit screen. The upgrader, e.g., the database administrator, uses the Upgrade Kit screen update the required versions of a software component. The upgrader, e.g., the database administrator, selects an upgrade kit, and, initiates a function to set the required versions for example, in the case of Siebel Remote, the upgrader presses the “Set Required Versions” button. The button finds all the software components that the upgrade affects and sets their maximum versions. The maximum versions are set to the versions that the upgrade kit installs.

The upgrader, e.g., the database administrator, uses a component or similar screen to “release” the new software component information to all users. The upgrader, e.g., the database administrator, selects a software component and presses the “Release” button. The button reads all the information about the selected software component and related software components, verifies the information, writes the information to the “compiled” LONG column and logs a transaction to replicate the information to all databases.

30 Detect and Apply Upgrade Kits

Upgrade programs of our invention automatically detect an upgrade by comparing the currently installed version of each component to the required versions. The client reads the required versions from the software component "compiled" LONG column at start up. Servers also read the required versions from the software component 5 "compiled" LONG column at start up.

For mobile users and regional databases, the upgrader, e.g., the database administrator, distributes the updated required versions to all remote databases. The docking client and Replication Agent query the docking server for the required schema versions before each synchronization session. If a change to the software 10 component compiled column occurs during a synchronization session, the docking client and Replication Agent reads the required versions after the synchronization session.

If any of the versions do not match, then an upgrade is required and the program searches for one or more upgrade kits to apply, applies the upgrade kits in two steps:

15 Download the upgrade kit archive file to the local machine

 Invoke the upgrade wizard to apply the upgrade kit to the local machine

For mobile and regional database installations, the docking client downloads the upgrade kit archive file from the server, typically the database server, to the local inbox directory. For connected users, the client downloads the upgrade kit archive 20 file in the file system to the temp directory on the local disk.

After the upgrade kit is accessible on the local machine, the upgrade wizard applies the upgrade. The upgrade wizard extracts files from the upgrade kit archive file, then performs each of the upgrade kit actions in sequence. If an error occurs, the upgrade wizard rolls back the upgrade kit actions and displays an error to the user. The 25 program detects and invokes upgrades again the next time.

After successfully completing all the upgrade kit actions, the upgrade wizard deletes the upgrade kit files from the local machine and restarts the program that invoked the upgrade.

Integration

The upgrade installation system uses a package, for example, Siebel Upgrades, to initialize and maintain remote databases. The upgrade wizard initializes new remote databases, performs database re-extracts, and handles database schema upgrades.

Extract Remote Databases - When extracting a remote database, Database Extract 5 creates an upgrade kit archive file in the outbox directory. This database extract archive file consists of an upgrade wizard driver file and several items to initialize the local database:

Create database. Copy the database template file (for mobile users)

Snapshot data. Import a database snapshot file containing visible data for the mobile 10 user

Sql files. Execute a set of SQL files that create users and initialize data in the database.

Database Initialization

The client, Replication Agent, docking client and standalone Dbinit (database 15 initialization) program invoke Dbinit to initialize a local database. Database initialization (Dbinit) ensures that all required versions exist on the local machine and creates a local database for the mobile client.

Dbinit performs these steps:

20 Connect to Server. Dbinit prompts the user for the name of the local mobile client, the password for the mobile client and the address of the Remote Server (the mobile user should get this information from his or her upgrader, e.g., the MIS staff, the vendor, or the database administrator,). Database initialization connects to the Remote server and validates the mobile client name, user and password.

25 Perform version check and download upgrade kits. Dbinit then performs a version check to ensure that all required software components exist on the local machine. Dbinit first downloads the required versions (i.e. the compiled information) from the docking server. Dbinit compares the required versions

against the versions on the local machine. If one or more versions do not match, then Dbinit downloads information about all (all? Not some?) upgrade kits. Dbinit then searches for upgrade kits to apply and downloads the upgrades kits to the local inbox directory.

- 5 Download extract snapshot file. Dbinit downloads the database extract snapshot file to the local inbox directory.

Create driver file. Dbinit creates an upgrade wizard driver file to apply the upgrade kits to the local machine and create the local database using the database extract snapshot file.

- 10 Run upgrade wizard. Dbinit invokes the upgrade wizard to apply the upgrade kits and initialize the local database.

If the initialization is successful, the upgrade wizard then restarts the calling program.

Automatic Initialization from the client

- When a mobile user runs the client against the local database, the client checks 15 whether the local database file exists. If the local database does not exist, the client prompts the user whether he wants to initialize a local database. If so, the Client invokes Dbinit to create the local database and also ensure that all software components are up-to-date.

Version Checking

- 20 At the beginning of each synchronization session, the docking client checks whether a database extract or a database schema upgrade is pending. This is because the docking client must perform a schema version check at the start of the docking session because the docking client must know whether it can upload transactions to the server database or must discard the transactions. The docking client also must 25 know whether it must perform a dbinit to re-initialize the local database.

After the docking client connects to the docking server, the docking client asks docking server for the server database schema versions. There are three possible outcomes:

Major Schema Change. If the major and minor schema versions of the local database and the server database do not match, then a database re-initialization is “required”. A change in the major or minor schema versions implies that the server database has undergone a major schema change. The docking client discards all pending transactions to upload. The docking client informs the mobile user and invokes the upgrade wizard to initialize the local database and upgrade sol, ware components (if any). If a database extract is not available, then the docking client displays an error asking the mobile user to contact the upgrader, e.g., the database administrator, to re-extract the docking client. Pending Dbinit., if there is no major schema change and the upgrader, e.g., the database administrator, has re-extracted the docking client, then the docking client must re-initialize the local database. The docking client saves all pending transactions to upload in a file in the inbox directory called dbinit.dx. The docking client invokes the upgrade wizard to create the new local database and upgrade any new software components. After initializing the local database, the upgrade wizard invokes the data merge utility (dmutil.exe) to apply the saved pending transactions in dbinit.dx to the local database. Dmutil.exe applies the transactions to the local database and logs new transactions to upload to the server database, as if the mobile user has re-entered all the transactions.

Minor Schema Change. If there is no major schema change and no pending dbinit, then the docking client proceeds to synchronize the docking client. Eventually, the docking client applies a transaction to upgrade the required versions of the Schema sol, are component. This update triggers the docking client to perform a version check and eventually causes the upgrade wizard apply an upgrade kit to upgrade the local database.

25 Initialize a Regional Database

The upgrader, e.g., the database administrator, on the regional database runs standalone database initialization program to initialize a regional database. The program connects to the Remote server and downloads the database extract archive file from outbox directory. The program then invokes the upgrade wizard to initialize 30 the regional database.

Replace a Regional Database

If the upgrader, e.g., the database administrator, on the HQ server runs database extract for an existing regional database, the upgrader, e.g., the database administrator, on the regional database needs to re-initialize the regional database. At the beginning of the each synchronization session, a Replication Agent checks 5 whether a database extract archive file is pending for the regional database. If so, the Replication Agent notifies the upgrader, e.g., the database administrator, and shuts down. The upgrader, e.g., the database administrator, must manually invoke the standalone database initialization program to initialize a regional database.

The Schema upgrade kit consists of one or more of the following items:

- 10 DDL file to make schema changes
 - DAT files to install seed data
 - Repimexp files to install Repository
 - SQL scripts to perform special upgrade steps, convert data, and the like
 - SQL script to update version numbers in the S_APP_VER table
- 15 Files to update software components. This includes adding, deleting and updating software component information. At the minimum, the file must update required versions of the components (e.g. you must use the new version of Tools against the new schema).
- 20 Files to install upgrade kits that defines. For example, upgrade kits to install a new version of Tools, Server and the like.

Installing the Schema at Customer Sites

- 25 The upgrader, e.g., the database administrator, receives the CD, or other media, and applies the upgrade kit to the test/configuration database. Before applying the upgrade kit, the upgrader, e.g., the database administrator, first shuts down all programs: both connected users and Server instances. Then he or she runs the upgrade wizard to apply the upgrade kit to the test database

The upgrade kit performs the following steps:

Makes schema changes

Imports seed data

Runs repimexp.exe to import the new Repository

Runs SQL scripts to perform special upgrade steps, convert data, and the like.

5 Updates the version numbers.

Runs files to update the software component tables.

Runs files to install - defined upgrade kits.

Accessing the Database after an Upgrade

At this point, the test/configuration database has the new schema and the software component required versions are set to the new versions. Any program that connects to the server database needs to apply one or more upgrade kits to get to the new required versions. For example, when the upgrader, e.g., the database administrator, logs in to the server database, the software used to login should detect a version mismatch and attempt to upgrade or call the upgrade. The upgrader, e.g., the database administrator, has two options to upgrade to the new Tools version: If an upgrade kit is available, download the upgrade kit and apply it to the local machine.

Install the new version from the CD-ROM. Then, use the version against the server database, upgrader, e.g., the database administrator, must use this option if this is the first time they installed software on the local machine.

20 If the upgrader, e.g., the database administrator, wants to let programs perform upgrades, he or she can register upgrade kits to upgrade the various software components. Otherwise, he or she can manually upgrade each machine by installing from the CD-ROM.

Customizing and Testing

25 Upgrader, e.g., the database administrator, can customize local installations in these three ways:

Database extensions such as new extension tables, extension columns or indexes. Configuration changes such as new CDF files, CFG files or report files.

5 Third party software changes such as new versions of Microsoft Word, Adobe Acrobat and the like.

Customers follow a well-defined procedure for creating and distributing these kinds of customizations. All of these customizations do not cause a major schema change; hence, they do not require a database re-extract.

10 Step 1: Make the configuration changes on the server database The upgrader, e.g., the database administrator, uses programs to customize end-user installations for their site, and merge the customer's repository with a new repository.

15 To effect configuration changes during the version or schema upgrade, new .CDF files need to be generated. This is done using an editor to customize CFG files. And a DBMS program such as Microsoft Access to customize reports. Microsoft Help Editor or the like may be used to customize the Help files

20 Programs in the upgrade kit compare versions and automatically detect the need to apply an upgrade the next time they start up. The method, apparatus, system, and program product of our invention upgrades connected users In a similar way, the server upgrades application servers, or, when present, a docking client upgrades local databases. A Replication agent upgrades regional databases.

25 The method, apparatus, system, and program product of our invention downloads the required upgrade kits and applies the upgrade to the local machine. If the database upgrade changed the major or minor schema versions, the upgrade method, system, apparatus, and program product of our invention automatically re-initializes the mobile or regional database.

A further aspect of our invention is the automatic setting of the required versions software components. Alternatively, the upgrader, e.g., the database administrator can update the required versions and initiate upgrades of one or more software components. In a networked environment the upgrader, e.g., the database

administrator, should be very careful when making changes to listing of required versions because updates to this file can cause programs at all locations to invoke upgrades

In most cases, the application server is self-upgrading. That is, the upgrader, e.g., the 5 database administrator, does not need to intervene to detect and apply an upgrade. However, there are exceptions. If the upgrade kit requires user intervention, then the upgrade software should wait until the upgrader, e.g., the database administrator, provides input.

Similarly, if a database extract is pending., for example, for a regional database, the 10 server must shutdown all access to the regional database, ensure that the transaction merger has successfully merged all pending .dx files from mobile clients, and initiate a database initialization process to re-initialize the regional database.

The software upgrade programs of the invention automatically detect and apply 15 upgrades as needed to maintain the correct software component versions on all machines. Users do not need to manually search for and apply upgrades. This is especially true of users connected on a LAN or WAN, who experience painless upgrades. The client automatically detects and applies upgrades as needed. If an upgrade is detected, the client notifies the user of the software components to upgrade, encourages the user to apply the upgrade and prompts the user to start the 20 upgrade. The system automatically downloads the appropriate upgrade kits to the local disk if the upgrade kit does not already exist on the local disk.

After the upgrade kit is available on the local machine, the client invokes the upgrade 25 wizard to apply the upgrade. The upgrade wizard displays the upgrade kit items prompts the user to start the upgrade. The upgrade wizard starts processing the upgrade kit items and regularly informs the user of the progress. When the upgrade wizard complete, it restarts the original program.

Mobile users also experience painless upgrades. Mobile users do not need to explicitly invoke database initialization. Attempting to start the Client against the local database with no local database available automatically invokes database 30 initialization to create the local database. Dbinit also ensures that all software components are up-to-date on the local machine.

Mobile users can download upgrade kits earlier than necessary by navigating to the Upgrade Kit screen and requesting to download the upgrade kit archive file in the next synchronization session.

- The upgrade software of our invention performs a version check at the start of each synchronization session. If an upgrade is detected, the client notifies the user of the software components to upgrade, encourages the user to apply the upgrade and prompts the user to start the upgrade, automatically downloads the appropriate upgrade kits to the local disk if the upgrade kit does not already exist on the local disk.
- 10 After the upgrade kit is available on the local machine, the client invokes the upgrade wizard to apply the upgrade. The upgrade wizard displays the upgrade kit items and prompts the user to start the upgrade. The upgrade wizard starts processing the upgrade kit items and regularly informs the user of the progress. When the upgrade wizard is complete, it restarts the original program.
- 15 If a re-initialization is required, the docking client invokes Dbinit to reinitialize the local database.

In one exemplification of our invention a component screen lets the upgrader, e.g., database administrators define software components and specify the required versions for software components. This screen also lets upgrader, e.g., the database administrator, specify dependencies between software components. For example, the client software component requires that the Schema component and the Schema component are already installed before the client can start up.

The component screen has two applets:, a software component applet which defines the name and required versions for a software component, and a required software component applet, which defines the list of other software components required to use the current software component. This applet is a child of the software component applet.

The Software Component applet lets the upgrader, e.g., the database administrator, enter the attributes of a software component. It can have one or more of the following fields:

Name (required). The name of the software component.

Comments (optional). The description of the software component. Minimum version (optional). The minimum version that must be installed on a machine to use this software component. If NULL, then the software component does not have a minimum version

5

Maximum version (optional). The maximum version that must be installed on a machine to use the software component. If NULL, then the software component does not have a maximum version. The applet verifies that the minimum version is less than or equal to the maximum version.

10

Locate method (optional). The method to use to get the install location of the software component. This is a picklist.

Locate Info (optional). Additional information for the locate method.

Version method (optional). Method to get the currently installed version of software component. This is a picklist.

15

Version Info (optional). Additional information for the version method.

The Software Component applet, lets the upgrader, e.g., the database administrator, define required software components for a software component. This applet has the following fields:

20

Required software component (required). The name of the required software component.

Comments (optional).

Start up flag (required). Specifies whether the required software component is required to start up the software component. Some required software component are used by a software component but not required for start up.

25

For example, the client requires Microsoft Word if the user uses Correspondence but Microsoft Word is not required when starting up the client. Upgrade Kit Item Arguments screen. It is possible to use this screen to

define the list of valid arguments for each upgrade kit item type. This screen has one applet:

Upgrade Kit Item Type Arguments applet. This applet lets the upgrader, e.g., the database administrator, enter the valid arguments for an upgrade kit item type. This 5 applet has the following fields:

Item type (required). The type of upgrade kit item to apply. Error! Reference source not found, shows the valid types of upgrade kit items and their respective arguments. This is a picklist.

Sequence (required). An integer denoting the sequence that upgrade wizard 10 passes the argument to apply the upgrade kit item.

Required Flag (required). Specifies whether the argument is required.

Comments (optional). The description of the upgrade kit item type argument.

Default value (optional). Default value of the argument.

Upgrade Kit applet

This 15 applet lets the upgrader, e.g., the database administrator, enter the attributes of an upgrade kit. This applet has the following fields:

Name (required). The name of the upgrade kit.

Title (required). The user-friendly name of the upgrade kit. The upgrade wizard displays this string on the title bar of the upgrade wizard dialog box.

This 20 value defaults to the name of the upgrade kit.

Comments (optional). The description of the upgrade kit. The upgrade wizard displays this description when the upgrade wizard starts up.

Status (required). The current status of the upgrade kit. The status is set 'Pending' when defining the upgrade kit. After the upgrader, e.g., the database administrator, presses the "Release" button, then the status changes 25 to 'Active'. The status changes to 'Inactive' if the upgrader, e.g., the database

administrator changes the status chooses the delete record action on the upgrade kit.

5 Upgrade kit archive file (optional). The attributes for the attached upgrade kit archive file. These are the attributes used by the file attachment business component and frames. Mobile users can navigate to this applet and request that Remote download the upgrade kit archive in the next synchronization session.

10 After the upgrader, e.g., the database administrator, "releases" the upgrade kit, any mobile or connected user can download and apply the upgrade kit to the local machine. The user navigates this applet and double clicks on an upgrade kit. If the upgrade kit archive file is not accessible on the local machine (i.e. mobile user), then the applet asks the user whether they want to submit a request to download the upgrade kit archive file in the next synchronization session. If the upgrade kit is already accessible on the local machine, then the applet invokes the upgrade wizard to 15 apply the upgrade kit to the local machine. The upgrade wizard waits for the client to exit before starting the upgrade.

Upgrade Kit Items applet. This applet lets the upgrader, e.g., the database administrator, enter the items for the upgrade kit. This applet has the following fields:

20 Sequence (required). An integer denoting the sequence in which to execute the upgrade kit items.

Title (required). The user-friendly title of the upgrade kit item. The upgrade wizard displays this string on the list of items to perform in the upgrade.

Comments (optional). The description of the upgrade kit item. The upgrade wizard displays this description when the user highlights the upgrade kit item.

25 Disk Space Estimate (optional). The amount of disk space required to apply upgrade kit item to a machine. The upgrader, e.g., the database administrator, provides this estimate. If the estimate is NULL, then the upgrade wizard makes a disk space estimate based on some predefined rules.

Item type (required). The type of upgrade kit item to apply. Error! Reference source not found, shows the valid types of upgrade kit items and their respective arguments.

The Upgrade Kit Item Arguments applet lets the upgrader, e.g., the database administrator, enter arguments for an upgrade kit item. The list of valid arguments for each upgrade kit item type is stored in the S_UPG_ITARG table. This applet creates intersection records between upgrade kit items and upgrade kit type arguments. This applet has the following fields:

- 5 Name (required). The name of the argument.
- 10 Comments (optional). The description of the upgrade kit item. The upgrade wizard displays this description when the user highlights the upgrade kit item.
- 15 Argument value (required).
- File attributes (optional). The attributes for files attached to the upgrade kit argument. The upgrader, e.g., the database administrator, attaches files to the upgrade kit item.

The Upgrade Kit Components applet lets the upgrader, e.g., the database administrator, define which software components are required for this upgrade. For example, you can not install version 3.1.2 on a machine unless you have version 3.1.0 or higher already, installed on that particular local machine. This applet also lets the upgrader, e.g., database administrators specify the sol, rare components that the upgrade kit affects.

- 20 This applet has the following fields:
 - 25 Software Component (required). The software component that is affected by this upgrade kit.
 - Minimum Installed Version (optional). This field stores the minimum version of the software component required to install this upgrade kit. This field can be left NULL if the upgrade kit does not require this software component.

Maximum Installed Version (optional). This field stores the maximum version of the software component required to install this upgrade kit. This field can be left NULL if the upgrade kit does not require this software component.

- 5 New Installed Version (optional). This field stores the new version of the software component if this upgrade kit is applied to a machine. This field can be left NULL if the upgrade kit does not install a new version of the software component.

10 The dialog in this applet verifies that the minimum version is less than or equal to the maximum version. It also verifies that the new version is greater or equal to the maximum version.

The Upgrade Kit Wizard includes a set of pre-defined dialogs to assist the upgrader, e.g., the database administrator, in creating upgrade kits that customers need most often. It may contain one or more of the following elements:

15 Screen 1: Choose Upgrade Kit Type

- 20 Database extension. Create an upgrade kit to apply the database extensions. The upgrade kit consists of two upgrade kit items: a DDL file to apply database schema changes and a DAT file to distribute the Repository data file to remote databases. The Repository data file contains a subset of repository tables needed to initialize the dictionary common api.

CDF files. Create an upgrade kit to distribute the new CDF files to all users.

25 Report files. Create an upgrade kit to distribute the new Report files to all users. Help files. Create an upgrade kit to distribute the new Help files to all users.

Sample Database. Create an upgrade kit to distribute the new Sample Database to all users.

Third Party Software. Create an upgrade kit to distribute the third party software to all users.

Screen 2: Full or Patch Install

Full install

5 Patch install

Screen 3: Version Information

Enter minimum required version: For full installs, defaults to NULL.
Otherwise, defaults to ?

10 Enter maximum required version: For full installs, defaults to NULL.
Otherwise, defaults.

Enter new version: defaults to software component's current maximum version + 1

15 The dialog verifies that the minimum version is less than or equal to the maximum version. It also verifies that the new version is greater or equal to the maximum version.

Screen 4: Files

Enter the source files: For full installs, select a directory that contains the files for the upgrade kit. The Upgrade Kit Wizard adds all the files in the directory and sub-directories to the upgrade kit.

20 For patch installs, select one or more files to add to the upgrade kit.

Enter the destination directory for the files.

Screen 5: Confirm

Review the information for the new upgrade kit and press OK to create the new upgrade kit. Otherwise, press Cancel to abort.

- A major component of the system, method, apparatus, and program product of our invention is the upgrade wizard. The primary function of the upgrade wizard is to apply upgrade kits. In a preferred exemplification of our invention the upgrade wizard has very simple user interface. When the upgrade wizard first starts up, it displays the title and description of the upgrade kit to the user. After the user presses the OK or other similar button, the upgrade wizard then displays a list of upgrade kit items to the user. The upgrade wizard displays the title of the upgrade kit item. When the user highlights a specific upgrade kit item, the upgrade wizard also displays the description of the chosen item in the bottom frame.
- After the user reviews the upgrade kit items and presses the START or other similar button, the upgrade wizard performs each of the upgrade kit items in order. A bar indicator may show an estimate of the progress of the upgrade. The upgrade wizard may also highlight the upgrade kit item after the item is completed.
- Algorithms and Procedures**
- Version Checking Function. To check a software component's version, the upgrade wizard gets the required versions from the database and the actual versions from the software component itself. To determine which components need checking, the upgrade wizard starts from the base component and walks through the required component network to get a list of the required components.
- The upgrade wizard programs call a function to do the version checking. The caller passes the "compiled" component information. The function returns a list of software components that are out-of-date and the current and required versions for each out-of-date software component.
- The function must check the version for each software component listed in the "compiled" component information. First, the function must locate the component. In this regard, "Error! Reference source not found" shows a list of methods for locating software components. Once located, the function can check the version of the component and the function can determine if the component can be upgraded. The CDF file stores a version number in the CDF file. The Upgrade Kit Wizard writes the value to the CDF file.

The CFG files: add a new version attribute in [] section. The Upgrade Kit Wizard writes the value to the CFG file.

Determining Which Upgrade to Run. The upgrade kit component table stores component and version information for an upgrade kit. This table describes which components an upgrade kit installs and which components are required by the upgrade. Detecting which upgrade kits to apply may be non-trivial.

The method, apparatus, system, and program product of our invention uses a recursive algorithm to search for the necessary upgrade kits. The algorithm is as follows:

```
10      If current_versions=desired_versions
          Call callback with current upgrade list
          Return TRUE;

        If upgrade list is full
          Return TRUE;

15      For each upgrade
        Do
          If upgrade already in upgrade list
            Continue;
            If upgrade can't be run now (i.e.
              upgrade_required_versions != current-versions)
20          Continue;
            Add upgrade to the list
            Apply upgrade information to current_versions
            Recurse
            Remove upgrade from the list
            Remove upgrade information from current_versions
25          Done
          Return TRUE;
```

This algorithm produces a list of upgrade kit to get from the current installed version to the required version. If there is more than one path, the function selects the path with the fewest upgrade kits.

Upgrade wizard. The upgrade wizard is a simple, standalone program whose sole function is to apply upgrade kits to a local machine. The upgrade wizard does not connect to or require the Database to run. The upgrade wizard reads all parameters and stores state information in simple files. The upgrade wizard need not be capable

of merging transactions. The upgrade wizard can perform the implementation portion of Dbinit (though not the transfer portion).

- Running the upgrade wizard. The upgrade wizard reads two types of files: a state file and an upgrade driver file. Both file types are human readable so support can “fix”
5 the files if needed.

State file. The state file contains a list of upgrades that need to be run and the
state of the upgrade. The state file is empty if there are no upgrades pending
or in-progress. The client and Server programs check the state file during
start-up. If the state file is not empty, they invoke the upgrade wizard to
10 resume the upgrade.

Driver file. The upgrade driver contains a list of upgrade kit items that need to
be performed for the upgrade. Error! Reference source not found, shows a list
of valid upgrade kit items.

At start up, the upgrade wizard reads the driver file and verifies that there is sufficient
15 disk space to apply the upgrade. The upgrade wizard uses the disk space estimate
supplied for each upgrade kit item. If the upgrader, e.g., the database administrator,
not provide an estimate, the upgrade wizard estimates the disk space using some Dun
algorithm. The upgrade wizard notifies the user if there is insufficient disk space on
local machine to apply the upgrade kits.

20 The upgrade wizard then reads the state file. If the state file is not empty, the upgrade
wizard first rolls back all changes by running the completed upgrade kit items in
reverse order.

The upgrade wizard estimates the time to apply the upgrade kits to the local machine
and waits for the user to start the upgrade. The upgrade wizard updates the status file
25 as it processes actions. It flushes the changes to disk (using fflush, and _commit).
The upgrade wizard saves data to a backup directory before performing each action.
Xxx shows the backup steps it takes for each upgrade kit items type. For example,
prior to executing any database related actions, the upgrade wizard backs up the local
database. We don't actually believe this will improve recoverability, but it can't hurt

(well, it can actually). When the upgrade completes successfully, the upgrade wizard deletes all backup files. It also deletes the upgrade status file is deleted.

Upgrading the upgrade wizard. The upgrade wizard has no dependencies on any other program. It does not load CFG files or DLLs. To support upgrading the 5 upgrade wizard itself, programs that invoke the upgrade wizard follows these steps:

Check if a “ready” version of the upgrade wizard executable exists.

If a “ready” version exists, delete the existing upgrade wizard executable and rename the “ready” version to current upgrade wizard executable.

10 If a upgrade wizard executable does not exist, rename the source upgrade wizard to the upgrade wizard executable.

The upgrade wizard renames the source upgrade wizard to the ready upgrade wizard when it finishes an upgrade. Preferably this happens when the upgrade status file is empty which will let the user change the 15 format of the status file. Alternatively, this can be done immediately after an upgrade which has produced an upgraded upgrade wizard executable so that the next upgrade can take advantage of new upgrade wizard features and presumably new upgrade wizard driver file syntax.

This algorithm ensures that the same upgrade wizard is be used throughout the 20 upgrade, even if it is restarted after installing a new version of the upgrade wizard.

Invoking the Version Checking Function. Each program calls the version checking function at pre-defined times.

Client

25 At startup, perform a version check for client. The client reads the required versions from the S_UPG_COMP table’s “compiled” LONG column and passes the information to the version checking function.

Server

5

At startup, the Server starts a new server component - Server Version Checker-to perform the version check. The Server Version Checker reads the required versions for the Server component from the S_UPG_COMP table's compiled" LONG column and passes the information to the version checking function.

10

Docking Client and Replication Agent

At the start of each synchronization session, the docking client (or replication agent) gets the schema version of the server database via a DRL message. The docking server reads the server database S_APP_VER table and sends the server database schema version to the docking client. If the major schema version on the server database and local database are different or a dbinit is pending, then the docking client invokes Dbinit to reinitialize the database.

15

Data Merge watches for transactions that update the "compiled" LONG column in S_UPG_COMP. For the docking client, Data Merge watches for changes to the" Client" component. For the Replication Agent, Data Merge watches for changes to the" Server" component.

20

As soon as Data Merge applies a transaction on this column for the "watched" component, Data Merge commits and stops merging transactions. The docking client then performs a version check. The Replication Agent starts the Server Version Checker to perform the version checks. If one or more required versions do not match, then the docking client (or Server Version Checker) finds one or more upgrade kits to apply, downloads the upgrade kit archive files (if not already accessible on the local disk) and invokes the upgrade wizard to apply the upgrade.

25

30

Dictionary Cache File. The dictionary cache file (i.e. the subset of the Repository needed by server programs and the docking client) provides a "cache" file which programmed to load the dictionary into memory. Using a "cache" file eliminates the need to load the dictionary data into all remote databases reduces the size of the rem(databases and also reduces the time to initialize or upgrade remote databases. It is possible, and is within the scope of our invention, to use the existing diccache.dat

mechanism for the “cache” file. The diccache.dat file contains a file representation G dictionary. In operation, a version number is stored in the diccache.dat file to identify its version and add new methods for reading the version number from the diccache.dat file is typically in the <_ROOT>\bin directory.

- 5 While our invention has been described with respect to certain preferred embodiments and exemplifications, it is not intended to limit the scope of the invention thereby.

CLAIMS

We claim:

1. A method of distributing software upgrades having a software version upgrade
5 wherein the method comprises:
 - a. providing database schema synchronization, and
 - b. providing support for installations and terminals in an enterprise.
2. The method of claim 1 wherein the method further comprises:
 - a. tracking the progress of upgrades, and
 - 10 b. automatically rolling back changes when an error occurs.
3. The method of distributing software version upgrades of claim 2, wherein the upgrade software can restart an upgrade from a last save point.
4. The method of distributing software version upgrades of claim 1 wherein:
 - a. a database administrator defines and distributes software and schema
15 upgrades from a central location, and
 - b. the database administrator monitors progress of the upgrades across all installations.
5. The method of distributing software version upgrades of claim 1 wherein the upgrade runs by itself and does not depend on other programs or data.
- 20 6. A method of providing software version upgrades and database schema synchronization comprising:
 - a. applying and distributing database schema changes to remote databases, and
 - b. applying schema changes and patches.

7. The method of providing software version upgrades and database schema synchronization of claim 6 wherein the software provider upgrades one or more of an installation and a terminal.
8. The method of providing software version upgrades and database schema synchronization of claim 7, wherein the installations and terminals comprise one or more of the group consisting of a connected client, a remote client, a regional server, and an application server.
9. A method of distributing and instantiating software version upgrades in a distributed computing environment comprising:
 10. a. setting minimum and maximum levels of the version for installed software, and
 - b. using those levels to define contents of software version upgrade kits.
10. The method of claim 9 further comprising writing the contents of the software version upgrade kits to a database and generating software version upgrade kit tables.
15. 11. The method of claim 10 wherein the method comprises:
 - a. building software version upgrade kits from the software version upgrade kit tables,
 - 20 b. downloading copies of the upgrade kits to clients to be upgraded, and
 - c. upgrading software on a client.
- 25 12. The method of claim 10 further comprising:
 - a. comparing the software version upgrade kit tables to locally installed software on a client, and
 - b. downloading to the client the software needing to be installed on the client.

13. The method of claim 12 further comprising comparing the upgrade kit tables with the locally installed software on a client at the startup of the client.
14. The method of claim 12 further comprising comparing the upgrade kit tables with the locally installed software on a client at the startup of a server.
- 5 15. The method of claim 12 further comprising comparing the upgrade kit tables with the locally installed software on a client at the startup of a software component.
16. A method of distributing a software version upgrade from a server to a client comprising
 - 10 a. comparing software on the server to locally installed software on the client at a docking session,
 - b. downloading to the client software needing to be installed on the client, and
 - c. instantiating the upgrade during a current docking session.
- 15 17. The method of claim 16 comprising instantiating the upgrade during the current docking session or a subsequent docking session.
18. A method of distributing a software version upgrade in a distributed computing environment having a server, a client, and at least one of the group consisting of a replicated database and a partially replicated database, comprising:
 - 20 a. comparing a database schema version on the client to a database schema version on the server,
 - b. reinitializing the database schema version on the client if the database schema version on the client and the database schema version on the server do not match, and
 - c. synchronizing the database schema version on the client with the database schema version on the server if the database schema versions on the client and server do match.

19. The method of claim 18 wherein the upgrade is a partial upgrade.
20. The method of claim 19 wherein comprising performing the upgrade, and distributing a new installation and a patches for an existing installations.
- 5 21. The method of claim 20 wherein the patch is at least one of the group consisting of a CDF file, an executable, a DLL, and a report.
22. A method of distributing software upgrades having a software version upgrade comprising:
- a. providing database schema synchronization,
 - 10 b. providing support for installations and terminals in an enterprise, and
 - c. automatically performing at least one of the functions in the group consisting of detecting existing programs and invoking upgrade programs.
23. The method of claim 22 wherein the upgrade programs further comprise at least one of the group consisting of clients and replication agents.
- 15 24. The method of claim 22 further comprising installation software that automatically detects when an upgrade is available and can be applied to a local installation.
25. The method of claim 22 wherein at least one of the software version upgrade programs allows a user to perform at least one of the functions in the group consisting 20 of cancelling an upgrade and deferring an upgrade.
26. The method of claim 22 wherein the software version upgrade performs at least one of the functions in the group consisting of keeping a user informed on the status of an upgrade, informing the user of a pending upgrade, informing the user of steps to be performed in an upgrade, providing time estimates for an upgrade, and 25 providing progress indicators during an upgrade.
27. The method of claim 22 wherein a database administrator distributes the software version upgrades.

28. The method of claim 22 further comprising allowing a user to use any method to install or update a software component.
29. The method of claim 22 further comprising allowing a software version upgrade to use a current state of software components to identify whether an upgrade
5 is needed.
30. The method of claim 1 wherein the software version upgrade allows a mobile user to download one or more upgrade kits to the user's local machine before the user requires the upgrade.
31. A program storage device readable by a machine, tangibly embodying a
10 program of instructions executable by a machine to perform method steps distributing software upgrades having a software version upgrade, said method steps comprising:
- a. providing database schema synchronization; and
 - b. providing support for installations and terminals in an enterprise.
32. An article of manufacture comprising a computer usable medium having
15 computer readable program code means embodied therein for causing distributing software upgrades having a software version upgrade, the computer readable program means in said article of manufacture comprising:
- a. computer readable program code means for causing a computer to effect providing database schema synchronization; and
 - b. computer readable program code means for causing a computer to effect providing support for installations and terminals in an enterprise.
20
33. A program storage device readable by a machine, tangibly embodying a program of instructions executable by a machine to perform method steps distributing software upgrades having a software version upgrade, said method steps comprising:
- 25 a. providing database schema synchronization; and
 - b. providing support for installations and terminals in an enterprise; and
 - c. tracking the progress of upgrades; and

- d. automatically rolling back changes when an error occurs.
34. An article of manufacture comprising a computer usable medium having computer readable program code means embodied therein for causing distributing software upgrades having a software version upgrade, the computer readable program means in said article of manufacture comprising:
- a. computer readable program code means for causing a computer to effect providing database schema synchronization; and
 - b. computer readable program code means for causing a computer to effect providing support for installations and terminals in an enterprise; and
 - c. computer readable program code means for causing a computer to effect tracking the progress of upgrades; and
 - d. computer readable program code means for causing a computer to effect automatically rolling back changes when an error occurs.
35. A program storage device readable by a machine, tangibly embodying a program of instructions executable by a machine to perform method steps distributing software upgrades having a software version upgrade, said method steps comprising:
- a. providing database schema synchronization; and
 - b. providing support for installations and terminals in an enterprise; and
 - c. tracking the progress of upgrades; and
 - d. automatically rolling back changes when an error occurs; and
 - e. restarting an upgrade from a last save point.
36. An article of manufacture comprising a computer usable medium having computer readable program code means embodied therein for causing distributing software upgrades having a software version upgrade, the computer readable program means in said article of manufacture comprising:

- a. computer readable program code means for causing a computer to effect providing database schema synchronization; and
 - b. computer readable program code means for causing a computer to effect providing support for installations and terminals in an enterprise; and
 - 5 c. computer readable program code means for causing a computer to effect tracking the progress of upgrades; and
 - d. computer readable program code means for causing a computer to effect automatically rolling back changes when an error occurs; and
 - e. computer readable program code means for causing a computer to effect restarting an upgrade from a last save point.
37. A program storage device readable by a machine, tangibly embodying a program of instructions executable by a machine to perform method steps providing software version upgrades and database schema synchronization having a software provider, said method steps comprising:
- 15 a. applying and distributing database schema changes to remote databases; and
 - b. applying schema changes and patches.
38. An article of manufacture comprising a computer usable medium having computer readable program code means embodied therein for causing providing 20 software version upgrades and database schema synchronization having a software provider, the computer readable program means in said article of manufacture comprising:
- 25 a. computer readable program code means for causing a computer to effect applying and distributing database schema changes to remote databases; and
 - b. computer readable program code means for causing a computer to effect applying schema changes and patches.

39. A program storage device readable by a machine, tangibly embodying a program of instructions executable by a machine to perform method steps distributing and instantiating software version upgrades in a distributed computing environment, said method steps comprising:
- 5 a. setting minimum and maximum levels of the version for installed software; and
- b. using those levels to define contents of software version upgrade kits.
40. An article of manufacture comprising a computer usable medium having computer readable program code means embodied therein for causing distributing and instantiating software version upgrades in a distributed computing environment, the computer readable program means in said article of manufacture comprising:
- 10 a. computer readable program code means for causing a computer to effect setting minimum and maximum levels of the version for installed software; and
- 15 b. computer readable program code means for causing a computer to effect using those levels to define contents of software version upgrade kits.
41. A program storage device readable by a machine, tangibly embodying a program of instructions executable by a machine to perform method steps distributing a software version upgrade from a server to a client, said method steps comprising:
- 20 a. comparing software on the server to locally installed software on the client; and
- b. downloading to the client software needing to be installed on the client; and
- c. carrying out the comparison and download at a docking session; and
- 25 d. instantiating the upgrade during a current docking session.
42. An article of manufacture comprising a computer usable medium having computer readable program code means embodied therein for causing distributing a

software version upgrade from a server to a client, the computer readable program means in said article of manufacture comprising:

- 5 a. computer readable program code means for causing a computer to effect comparing software on the server to locally installed software on the client; and
 - 10 a. computer readable program code means for causing a computer to effect downloading to the client software needing to be installed on the client; and
 - 15 a. computer readable program code means for causing a computer to effect carrying out the comparison and download at a docking session; and
 - 20 a. computer readable program code means for causing a computer to effect instantiating the upgrade during a current docking session.
43. A program storage device readable by a machine, tangibly embodying a program of instructions executable by a machine to perform method steps distributing a software version upgrade in a distributed computing environment having a server, a client, and at least one of the group consisting of a replicated database and a partially replicated database, said method steps comprising:
- 25 a. comparing a database schema version on the client to a database schema version on the server; and
 - b. reinitializing the database schema version on the client if the database schema version on the client and the database schema version on the server do not match; and
 - c. synchronizing the database schema version on the client with the database schema version on the server if the database schema versions on the client and server do match.
44. An article of manufacture comprising a computer usable medium having computer readable program code means embodied therein for causing distributing a software version upgrade in a distributed computing environment having a server, a

client, and at least one of the group consisting of a replicated database and a partially replicated database, the computer readable program means in said article of manufacture comprising:

- 5 a. computer readable program code means for causing a computer to effect comparing a database schema version on the client to a database schema version on the server; and
- 10 a. computer readable program code means for causing a computer to effect reinitializing the database schema version on the client if the database schema version on the client and the database schema version on the server do not match; and
- 15 a. computer readable program code means for causing a computer to effect synchronizing the database schema version on the client with the database schema version on the server if the database schema versions on the client and server do match.
- 20 45. A program storage device readable by a machine, tangibly embodying a program of instructions executable by a machine to perform method steps distributing software upgrades having a software version upgrade, said method steps comprising:
 - a. providing database schema synchronization; and
 - b. providing support for installations and terminals in an enterprise; and
 - c. automatically performing at least one of the functions in the group consisting of detecting existing programs and invoking upgrade programs.
- 25 46. An article of manufacture comprising a computer usable medium having computer readable program code means embodied therein for causing distributing software upgrades having a software version upgrade, the computer readable program means in said article of manufacture comprising:
 - a. computer readable program code means for causing a computer to effect providing database schema synchronization; and

- b. computer readable program code means for causing a computer to effect providing support for installations and terminals in an enterprise; and
- c. computer readable program code means for causing a computer to effect automatically performing at least one of the functions in the group consisting of detecting existing programs and invoking upgrade programs.
- 5
47. A program storage device readable by a machine, tangibly embodying a program of instructions executable by a machine to perform method steps distributing software upgrades having a software version upgrade, said method steps comprising:
- a. providing database schema synchronization; and
- 10 b. providing support for installations and terminals in an enterprise; and
- c. allowing a mobile user to download one or more upgrade kits to the user's local machine before the user requires the upgrade.
48. An article of manufacture comprising a computer usable medium having computer readable program code means embodied therein for causing distributing software upgrades having a software version upgrade, the computer readable program means in said article of manufacture comprising:
- a. computer readable program code means for causing a computer to effect providing database schema synchronization; and
- 15 b. computer readable program code means for causing a computer to effect providing support for installations and terminals in an enterprise; and
- c. computer readable program code means for causing a computer to effect allowing a mobile user to download one or more upgrade kits to the user's local machine before the user requires the upgrade.
- 20
49. The method of claim 1 wherein the software version upgrade upgrades both database schemas and software.
- 25
50. The method of claim 1 wherein the software version upgrade is database independent.

51. The method of claim 1 further comprising checking for versions at one or more of the group consisting of startup and docking initiation.

52. The method of claim 1 further comprising upgrading a file attachment and an associated database file in a same transaction.

AMENDED CLAIMS

[received by the International Bureau on 26 July 1999 (26.07.99);
original claims 1-52 replaced by amended claims 1-15 (5 pages)]

1. A method of distributing and installing softgrade upgrades on client computers in a client server system comprising:

5 setting minimum and maximum versions of installed software for clients;

defining contents of software version upgrade kits from the minimum and maximum versions of the installed software, the software version upgrade kits comprising files, actions, and an upgrade wizard to upgrade one or more software components from one version to another version;

10 writing the contents of the software version upgrade kits to a database as a table of contents, said table of contents showing the contents of an upgrade kit and which software components are required by a corresponding upgrade;

interrogating installed software on a client to determine the installed version on the client;

15 comparing the table of contents of software version upgrade kits to software installed on a client to determine software version upgrade kits needed to be invoked on the client to effect upgrades from a currently installed software version to a required software version;

building the software upgrade kits from the table of contents;

20 downloading copies of the software upgrade kits from the server to a client to be upgraded;

creating a backup of local files before applying the upgrade; and

25 invoking the upgrade wizard to upgrade software on the client, said upgrade wizard reading a list of upgrade kit items to be performed for the software version upgrade from a driver file and a list of upgrades to be run and the state of each upgrade from a state file.

WO 99/45465

49

2. The method of claim 1 tracking the progress of an upgrade, rolling back changes when an error occurs, instantiating the backed up local files, and restarting the upgrade from a save point.
3. The method of claim 1 comprising monitoring the progress of a software upgrade on a client from a server.
4. The method of claim 1 downloading one or more upgrade kits to a client before the client requires the upgrade.
5. The method of claim 1 wherein the software being upgraded is database management software, and the upgrades further include database schema changes.
- 10 6. A client-server computer system having a server computer and at least one client computer periodically docking with the server computer, said server computer having a database management system and a database thereon, and wherein said database is partially replicated from the server computer to the client computer during docking, said server and said client further having upgrading program code for applying upgrades to software resident on the client computer from the server computer, said upgrading program code comprising:
- program code for setting minimum and maximum versions of installed software for the client computer;
- program code for defining contents of software version upgrade kits from the minimum and maximum versions of the installed software, the software version upgrade kits comprising files, actions, and an upgrade wizard to upgrade one or more software components from one version to another version;
- 20 25 program code for writing the contents of the software version upgrade kits to a database as a table of contents, said table of contents showing the contents of an upgrade kit and which software components are required by a corresponding upgrade;
- 25 program code for interrogating installed software on the client to determine the installed version of the software on the client computer;
- program code for comparing the table of contents of the software version upgrade kits to the software installed on the client computer to determine software version upgrade

kits needed to be downloaded from the server computer to the client computer and invoked on the client computer to effect upgrades from a currently installed software version to a required software version;

5 program code on the server computer for building the software upgrade kits from the table of contents;

program code for downloading copies of the software upgrade kits from the server computer to the client computer;

program code for creating on the client computer a backup of local files thereon before applying the upgrade; and

10 program code for invoking the upgrade wizard to upgrade software on the client, said upgrade wizard reading a list of upgrade kit items to be performed for the software version upgrade from a driver file and a list of upgrades to be run and the state of each upgrade from a state file.

7. The client-server computer system of claim 6 further including program code for tracking the progress of an upgrade, rolling back changes when an error occurs, instantiating the backed up local files, and restarting the upgrade from a save point.

15 8. The client-server computer system of claim 6 further including program code for monitoring the progress of a software upgrade on a client from a server.

9. The client-server computer system of claim 6 further including program code for 20 downloading one or more upgrade kits to a client during docking and before the client requires the upgrade, and installing the upgrade subsequent to docking.

10. The client-server computer system of claim 6 wherein the upgrading program code for applying upgrades to software resident on the client computer from the server computer further includes program code for upgrading database schema resident on the 25 client computer.

11. A program product for use in a client-server computer system for applying software upgrades to software resident on a client computer from a server computer, said program product comprising software upgrading program code present on storage media

51

on the server computer and the client computer, said software upgrading program code comprising:

program code for setting minimum and maximum versions of installed software for the client computer;

5 program code for defining contents of software version upgrade kits from the minimum and maximum versions of the installed software, the software version upgrade kits comprising files, actions, and an upgrade wizard to upgrade one or more software components from one version to another version;

10 program code for writing the contents of the software version upgrade kits to a database as a table of contents, said table of contents showing the contents of an upgrade kit and which software components are required by a corresponding upgrade;

program code for interrogating installed software on the client to determine the installed version of the software on the client computer;

15 program code for comparing the table of contents of the software version upgrade kits to the software installed on the client computer to determine software version upgrade kits needed to be downloaded from the server computer to the client computer and invoked on the client computer to effect upgrades from a currently installed software version to a required software version;

20 program code on the server computer for building the software upgrade kits from the table of contents;

program code for downloading copies of the software upgrade kits from the server computer to the client computer;

program code for creating on the client computer a backup of local files thereon before applying the upgrade; and

25 program code for invoking the upgrade wizard to upgrade software on the client, said upgrade wizard reading a list of upgrade kit items to be performed for the software version upgrade from a driver file and a list of upgrades to be run and the state of each upgrade from a state file.

12. The program product of claim 11 further including program code for tracking the progress of an upgrade, rolling back changes when an error occurs, instantiating the backed up local files, and restarting the upgrade from a save point.
13. The program product of claim 11 further including program code for monitoring
5 the progress of a software upgrade on a client from a server.
14. The program product of claim 11 further including program code for downloading one or more upgrade kits to a client during docking and before the client requires the upgrade, and installing the upgrade subsequent to docking.
15. The program product of claim 11 wherein the upgrading program code for
10 applying upgrades to software resident on the client computer from the server computer further includes program code for upgrading database schema resident on the client computer.

STATEMENT UNDER ARTICLE 19:

The original claims have been canceled, and new claims presented which clearly distinguish over the art cited and point out the novelty and inventive step of Applicants' claimed invention.

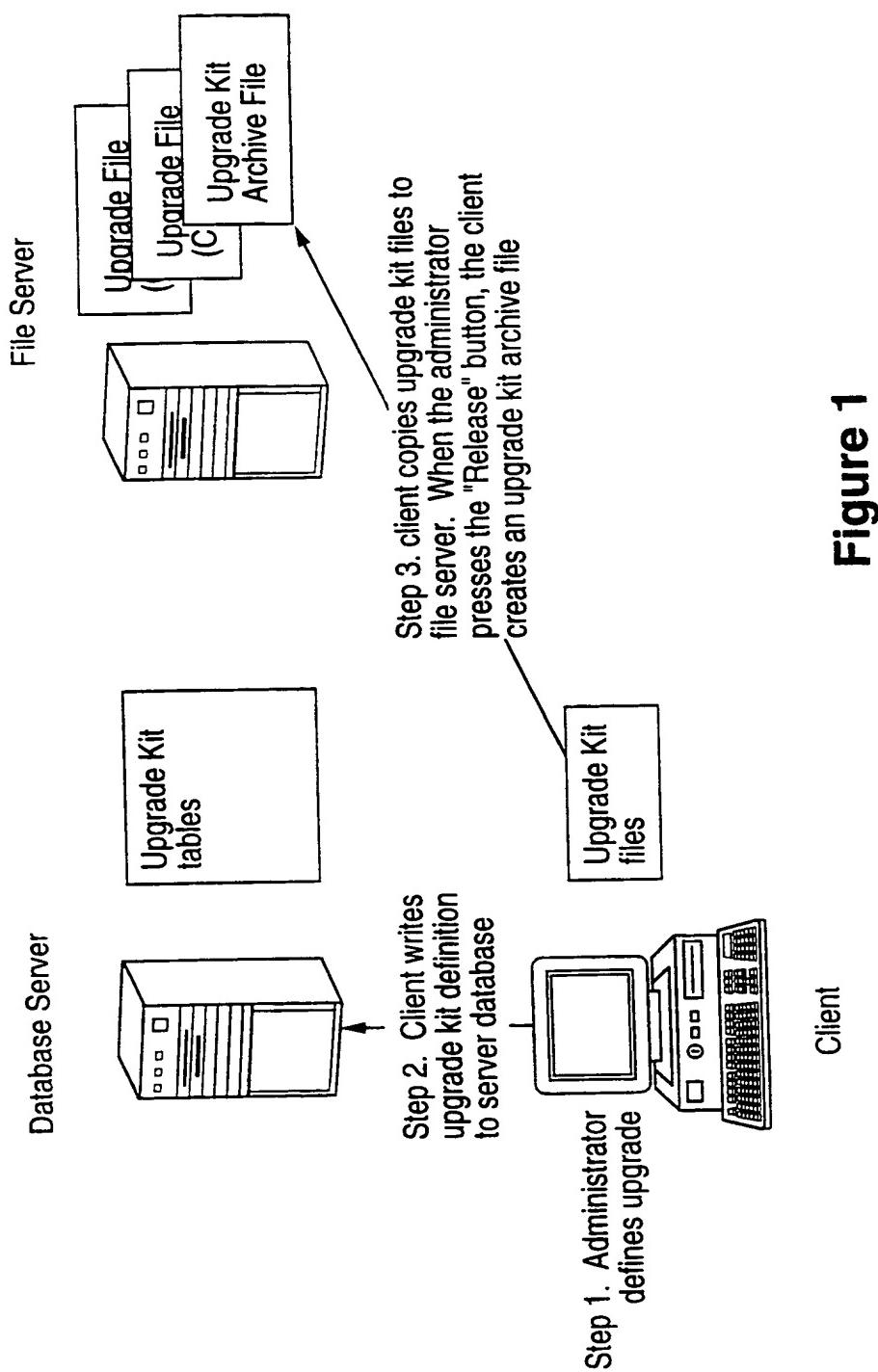
Applicants' invention is a server controlled upgrade, generally initiated from the server, with resources on the server and resources downloaded from the server.

The new claims positively recite a method of, a system for, and a program product for

- (i) setting minimum and maximum versions of installed software for clients;
- (ii) using the "minimum" and "maximum" version information to define the contents of software version upgrade kits, where the software version upgrade kits contain files, actions, and an upgrade wizard to upgrade one or more software components from one version to another version;
- (iii) writing the contents (that is, the "table of contents") of the software version upgrade kits to a database, the table of contents specifically showing the contents of an upgrade kit and which software components are required by a corresponding upgrade;
- (iv) interrogating installed software on a client to determine the installed version on the client;
- (v) comparing the table of contents of the relevant software version upgrade kits to software installed on a client to determine which software version upgrade kits are needed to effect upgrades from a currently installed software version to a required software version;
- (vi) building, on the server, the software upgrade kits from the table of contents;
- (vii) downloading copies of the software upgrade kits from the server to a client to be upgraded;
- (viii) creating a backup of local files on the client (that is, local files which are the subject of some action as part of the upgrade) before applying the upgrade; and
- (ix) invoking the upgrade wizard to upgrade software on the client, where the upgrade wizard reads a list of upgrade kit items to be performed for the software version upgrade from a driver file and a list of upgrades to be run and the state of each upgrade from a state file.

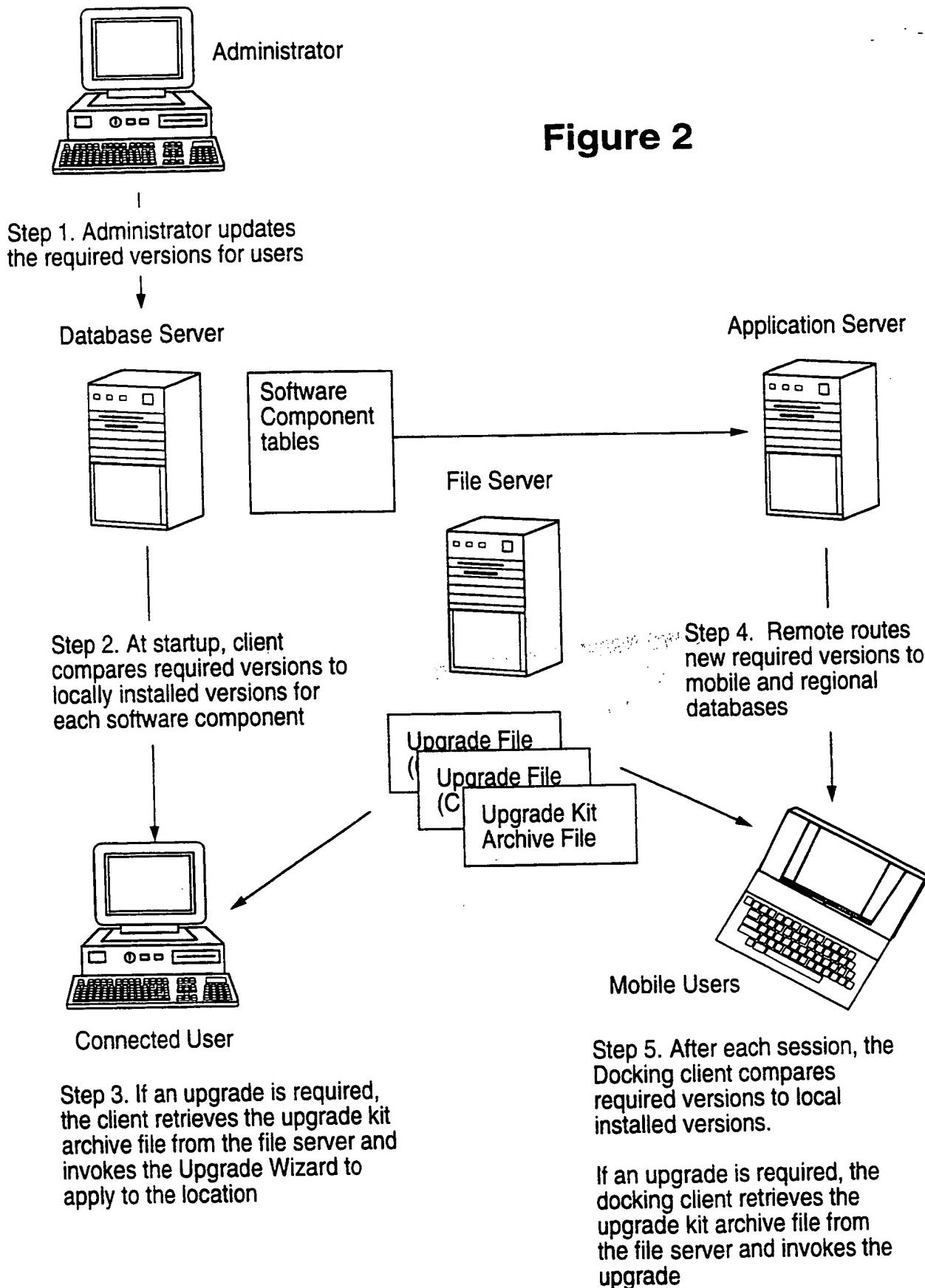
This is to be contrasted with the system and method described in Cheng, EP-0-811-942-A2. The Cheng system and method is client oriented and controlled, where the server acts as a centralized order taker and payment receiver, but the software upgrades are ordered from separate sites (possibly, but not necessarily hyperlinked from the server), based on a comparison done by the client and at the client. In Cheng the client application 104 (resident on the client) determines the need for an upgrade, the client picks which software to update, the client application 104 (resident on the client) downloads the upgrades from a site other than the "server". The primary function of the server appears to be to take the client generated inventory of installed software on the client and from this client generated inventory suggest upgrades, provide URL's for those upgrades, and receive payment for the upgrades.

1/4



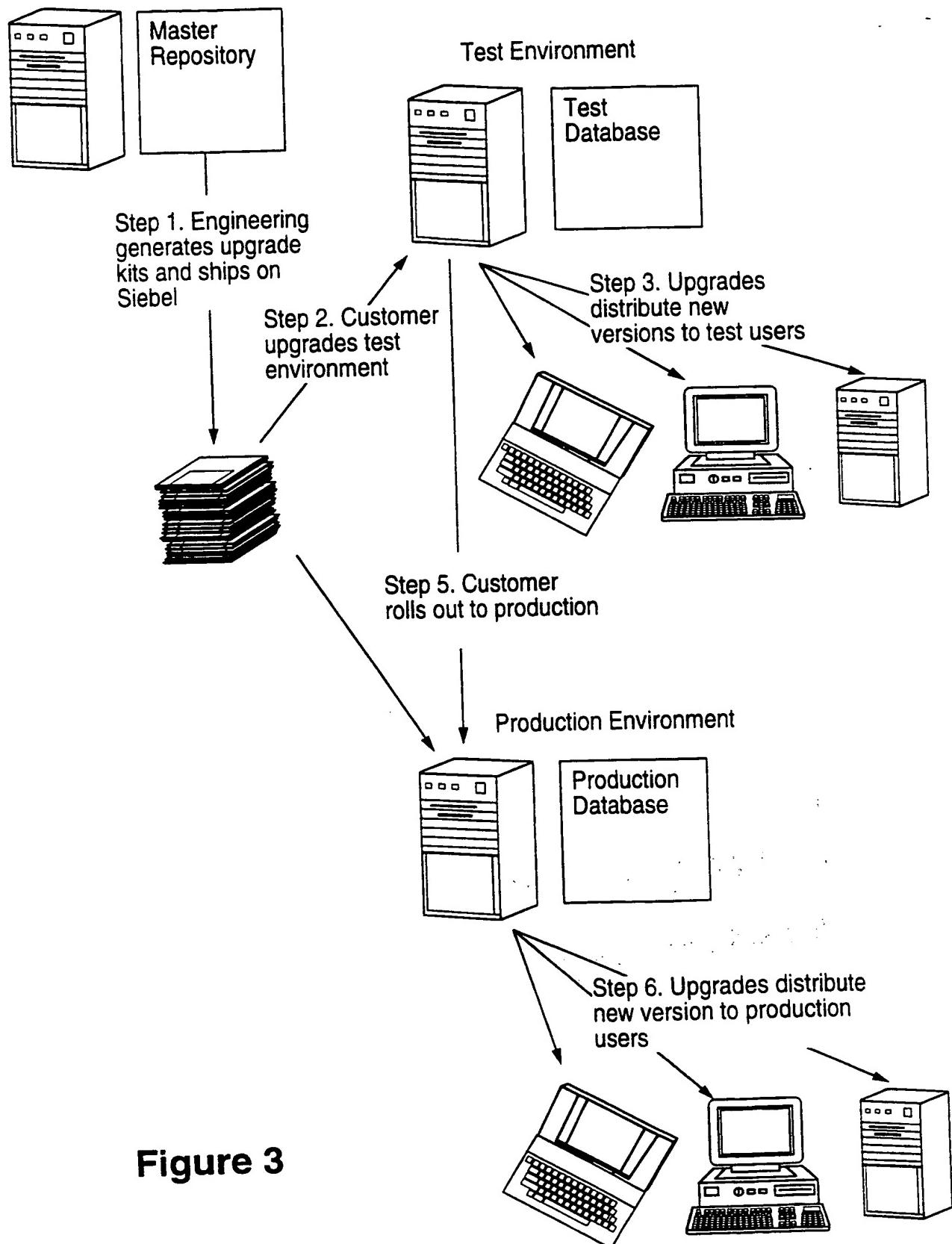
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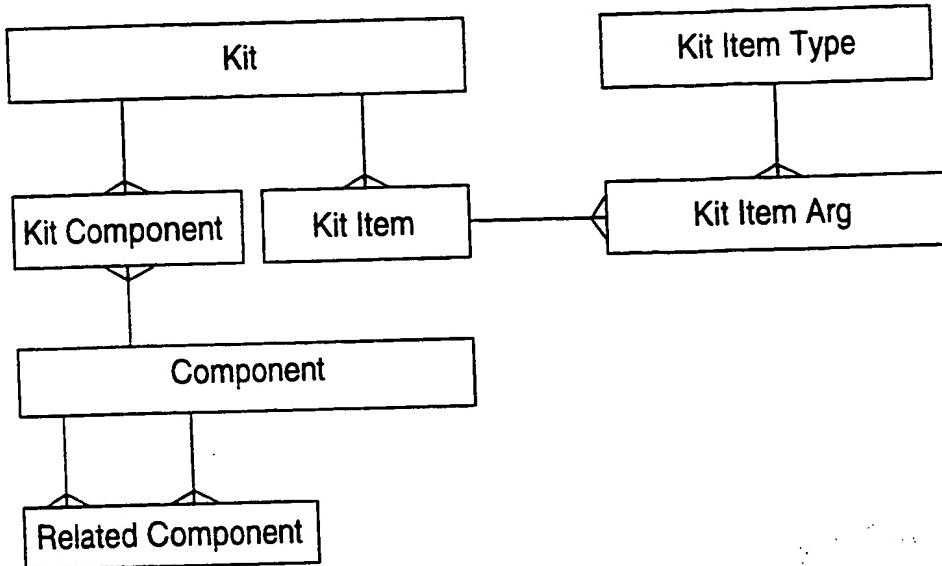
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3/4

**Figure 3**

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4/4

**Figure 4**

Action	Arguments	Description
FileCopy	File, directory	Copies file into directory
FilePatch	File, directory	Like copy, but uses incremental data technology
FileDelete	File, directory	Deletes file from directory
FileExecute	ExeFile, exeArgs	Invoke a stand-alone executable (may be interactive)
DbSql	SqlFile	Run the statements in sqlFile
DbDAT	DataFile	Load data from dataFile
DbDDL	DDLFile	Issue ddl needed to make local database schema match file
Repimexp	RepimexpFile	Load repository data from repimexpfile

Figure 5

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/04581

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : G06F 09/445

US CL : 395/712

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 395/712; 707/203

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DIALOG, DERWENT

search terms: software upgrade, database schema upgrades, upgrade kit, database synchronization

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ---	EP 0 811 942 A2 (CHENG et al.) 10 December 1997, pages 5-18, Figures 1, 2, 9, 10, 13 and 17	1, 4-5, 9-17, 22- 29 31-32, 39-42, 45-46, 50, 51
Y		2-3, 6-8, 33-38, 49, 52
Y	US 5,715,462 A (IWAMOTO et al.) 03 February 1998, col. 5, lines 18-55, col. 4, lines 59-61, Figures 1 and 3-4	2-3, 7-8, 33-36
Y	M2 Communications, Siebel Announces Production Shipment of Siebel Enterprise Applications Version 3.0, M2 Presswire, 28 February 1997, page 2	6-8, 37, 38, 49, 52

 Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"B" earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

10 MAY 1999

Date of mailing of the international search report

26 MAY 1999

Name and mailing address of the ISA/US
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INTERNATIONAL SEARCH REPORTInternational application No.
PCT/US99/04581**C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,155,847 A (KIROUAC et al.) 13 October 1992, see entire document	
A	US 5,586,304 (STUPEK, JR. et al.) 17 December 1996, see entire document	
A	US 5,666,501 A (JONES et al.) 09 September 1997, see entire document	
A	US 5,684,952 A (STEIN) 04 November 1997, see entire document	